

REMARKS

Claims 1, 5-7, 11-15, 19-20, 24-26, 30-31 and 35-36 are pending in this application.

Claims 1, 15, 26 and 31 are independent. Claims 7, 11-14, 20 and 24-25 are withdrawn from consideration pursuant to a Restriction Requirement.

The present invention is directed to a piston made of aluminum cast alloy having improved thermo-mechanical fatigue resistance. A Ca content of 0.0005-0.003 mass % provides a desirable homogenous texture that is not achieved outside of this range.

<Addition of Ca (Calcium): 0.0005-0.003 mass %>

For example, in the case where the crystal grain refining elements such as Ti (Titanium), Zr (Zirconium), V (Vanadium) and the like are contained, if a trace of Ca (Calcium) is added, the crystal grain is more refined, and the effect that the structure is homogenized is obtained. In the case where the crystal grain refining elements such as Ti (Titanium) and the like are not contained, or in the case where if these are contained but the content does not satisfy the above-described range of the present invention, even if Ca (Calcium) is added, the effect of refining the crystal grain is not obtained. Moreover, even in the case where it is in the component range of the present invention, **if Ca (Calcium) content is less than 0.0005 mass %, the effect of refining the crystal grain is not obtained. In addition, in the case where it exceeds over 0.003 mass %, the dendrite structure becomes conspicuous, and the structure becomes heterogeneous.** Moreover, since if Ca (Calcium) content is too much, the pores may tend to be easily generated, it is more preferable that the upper limit of Ca (Calcium) content is made equal to or less than 0.002 mass %. Specification at page 26, line 14 to page 27, line 6 (emphasis added).

As known from Figs. 5-8, the crystal grain of alloys of Examples A1, A2 in which **Ca (Calcium) content is equal to or more than 0.0005 mass %** is finer and its structure is more homogenized comparing to those of alloys of Comparative Examples A3, A4 in which **Ca (Calcium) content is less than 0.0005 mass %**. Specification at page 45, lines 3-7 (emphasis added).

As known from Figs. 9-11, in alloys of Example B1 in which **Ca (Calcium) content is equal to or less than 0.003 mass %**, the alignment of dendrites is hardly observed, and the micro-structure is homogenized, however, in alloys of Comparative Examples B2, B3 in which **Ca (Calcium) content is more than 0.003 mass %**, the alignment of dendrites is clear and the micro-structure is heterogeneous. Specification at page 47, lines 17-23 (emphasis added).

Claims 1, 4-6, 15, 18-19, 26, 29-31 and 34-36 are rejected under 35 U.S.C. § 103(a) over RU 2092604C1 ("RU-604") and "Aluminum standards and data 2003" page 1-6.

RU-604 discloses an aluminum-based alloy containing (in wt.%) "at least one other element selected from group comprising bismuth, barium, antimony, calcium, sodium, potassium and strontium 0.03-0.15". RU-604 at English-language abstract.

"Aluminum standards and data 2003" is cited for disclosing the addition of Na, Sr, Ca and/or P to 3xx and 4xx type Al-Si foundry alloys in order to modify the structure; and that 0.005-0.15% Ca and $\leq 0.060\%$ P are effective modifiers. Final Rejection at page 2, section 2, lines 10-13.

However, the disclosure in the cited prior art of a minimum of 0.005 wt% Ca fails to suggest the limitation of independent Claims 1, 15, 26 and 31 of an aluminum cast alloy that comprises "Ca (Calcium) : 0.0005-0.003 mass %".

The Advisory Action asserts:

Concerning the minimum of Ca taught by "Aluminum Standards and Data 2003" of 0.005% Ca, the examiner submits said minimum is a close approximation of the presently claimed max. of 0.003%. Advisory Action at page 2, lines 1-3.

The Advisory Action further asserts:

A prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)(Court held as proper a rejection of a claim directed to an alloy of "having 0.8% nickel, 0.3% molybdenum, up to 0.1% iron, balance titanium" as obvious over a reference disclosing alloys of 0.75% nickel, 0.25% molybdenum, balance titanium and 0.94% nickel, 0.31 % molybdenum, balance titanium.). Advisory Action at page 2, lines 3-9. See also MPEP 2144.05.I, page 2100-140.

However, the Advisory Action and the MPEP are misinterpreting *Titanium Metals* (copy attached).

Titanium Metals actually states:

As admitted by appellee's affidavit evidence from James A. Hall, the Russian article discloses two alloys having compositions very close to that of claim 3, which is 0.3% Mo and 0.8% Ni, balance titanium. The two alloys in the prior art have 0.25% Mo - 0.75% Ni and 0.31% Mo - 0.94% Ni, respectively. **The proportions are so close that prima facie one skilled in the art would have expected them to have the same properties.** Appellee produced no evidence to rebut that prima facie case. The specific alloy of claim 3 must therefore be considered to have been obvious from known alloys. *Titanium Metals Corp. of America v. Banner*, 227 USPQ 773, 779 (Fed. Cir. 1985)(emphasis added).

Thus, in *Titanium Metals* the Russian article disclosed titanium alloys containing Mo implicitly in a range of 0.25% to 0.31%, and Ni implicitly in a range of 0.75% to 0.94%. The rejected claim 3 contained 0.3% Mo, which was within the implicit prior art range of 0.25% to 0.31% Mo, and 0.8% Ni, which was within the implicit prior art range of 0.75% to 0.94% Ni. Not surprisingly, the Federal Circuit found rejected claim 3 to be *prima facie* obvious.

Because the Russian article did not explicitly disclose ranges for Mo and Ni, but instead disclosed two alloy compositions, the Federal Circuit observed "[t]he proportions [in the two alloy compositions] are so close [to rejected claim 3] that prima facie one skilled in the art would have expected them to have the same properties".

Contrary to the Advisory Action and the MPEP, the Federal Circuit never took the position in *Titanium Metals* that "[a] prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties". How close is close enough? The position in the Advisory Action and the MPEP is simply a Patent Office excuse for improper hindsight reasoning.

In the present application, the "Ca (Calcium) : 0.0005-0.003 mass %" of independent Claims 1, 15, 26 and 31 does not overlap the 0.005-0.15% Ca of "Aluminum standards and data 2003". Applicant's **maximum** of 0.003% Ca is **only 60%** of the prior art **minimum** of 0.005% Ca. The cited prior art does not suggest "Ca (Calcium) : 0.0005-0.003 mass %".

The Advisory Action asserts:

Once a reference teaching product appearing to be substantially identical is made the basis of a rejection, and **the examiner presents evidence or reasoning** tending to show **inherency**, the **burden shifts** to the applicant to show an unobvious difference. Advisory Action at page 2, lines 10-12. See also MPEP 2112.V, page 2100-48, column 2.

However, the Examiner has presented no evidence tending to show that the prior art minimum of 0.005% Ca results in the homogenous texture achieved by the Ca content of 0.0005-0.003 mass % of independent Claims 1, 15, 26 and 31. "Aluminum standards and data 2003" only discloses that Ca is a "structure modifying element". However, "Aluminum standards and data 2003" is silent about how Ca modifies structure. Instead of producing the homogeneous structure, the specification discloses, as discussed above, that the prior art's minimum of 0.005% Ca produces a heterogeneous structure.

... [I]f Ca (Calcium) content is less than 0.0005 mass %, the effect of refining the crystal grain is not obtained. In addition, in the case where it exceeds **over 0.003 mass %**, the dendrite structure becomes conspicuous, and the structure becomes **heterogeneous**. Specification at page 26, line 26 to page 27, line 3 (emphasis added).

Because the Examiner has not provided evidence or reasoning tending to show that the homogeneous texture achieved by the Ca content of 0.0005-0.003 mass % of independent Claims 1, 15, 26 and 31 is inherent (i.e., necessarily present) in the cited prior art, the **burden has NOT shifted** to Applicants to show an unobvious difference between Applicants' piston made of aluminum cast alloy having a maximum of 0.003% Ca and the cited prior art's

aluminum alloy having a minimum of 0.005% Ca. The **burden remains with the Examiner** to establish a *prima facie* case of obviousness.

Because the cited prior art fails to suggest the limitation of independent Claims 1, 15, 26 and 31 of an aluminum cast alloy that comprises "Ca (Calcium) : 0.0005-0.003 mass %", the rejection under 35 U.S.C. § 103(a) should be withdrawn.

Any *prima facie* case for the obviousness of independent Claims 1 and 31 is rebutted by the significant improvement in homogeneous texture that is achieved by independent **Claims 1 and 31 at 0.0005 mass% Ca and above**. The Advisory Action admits that "the claimed min. Ca is **critical** and obtains superior results... for a low Mg embodiment [of independent Claims 1 and 31]". The showing of improved homogeneous texture in the specification at Table 9 and in the attached Declaration Under 37 C.F.R. § 1.132 is commensurate with the range of "Ca (Calcium) : 0.0005-0.003 mass%" of the low Mg embodiment of independent Claims 1 and 31.

Similarly, any *prima facie* case for the obviousness of independent Claims 15 and 26 is rebutted by the significant improvement in homogeneous texture that is achieved by independent **Claims 15 and 26 at 0.003 mass% Ca and below**. The Advisory Action admits that "the claimed max. of Ca is **critical** to obtaining a fine homogeneous structure for a medium Mg embodiment [of independent Claims 15 and 26]". The showing of improved homogeneous texture in the specification at Table 10 and in the attached Declaration Under 37 C.F.R. § 1.132 is commensurate with the range of "Ca (Calcium) : 0.0005-0.003 mass%" of the medium Mg embodiment of independent Claims 15 and 26.

The cited prior art fails to suggest the significant improvement in homogeneous texture achieved by the present invention over these ranges of Ca. Thus, any *prima facie* case of obviousness is rebutted. As a result, the rejection under 35 U.S.C. § 103(a) should be withdrawn.

Pursuant to M.P.E.P. § 821.04, after independent product Claims 1 and 15 are allowed, Applicants respectfully request rejoinder, examination and allowance of withdrawn method Claims 7, 11-14, 20 and 24-25, which include all of the limitations of product Claims 1 and 15, respectively.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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Attached:

Titanium Metals Corp. of America v. Banner, 227 USPQ 773 (Fed. Cir. 1985)
Declaration Under 37 C.F.R. § 1.132.

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